

REMARKS

The Examiner's Action mailed on June 30, 2006, has been received and its contents carefully considered. Additionally attached to this Request for Reconsideration is a Petition for a One-month Extension of Time, extending the period for response to October 30, 2006.

Claim 1 is the independent claim, and claims 1-7 and 9 remain pending in the application. For at least the following reasons, it is submitted that this application is in condition for allowance.

The Examiner has rejected claims 1-7 and 9 as being anticipated by *Hsu et al.* (USP 6,143,645). It is submitted that these claims are *prima facie* patentably distinguishable over the cited reference for at least the following reasons.

Applicant's independent claim 1 is directed to a method of making a semiconductor device which has a semiconductor substrate with a contact hole that is filled by an aluminum-containing thin film. A silicon-containing thin film is formed in a region having a predetermined area, and which includes an inner surface of the contact hole. The aluminum-containing thin film is formed on the surface of the semiconductor substrate on which the silicon-containing thin film is formed. The semiconductor substrate, on which the aluminum-containing thin film is formed, is heated, causing silicon to diffuse with respect to aluminum. Moreover, this claim recites that the semiconductor substrate is provided with a plurality of cells, each containing the contact hole. Moreover, the ratio of the amount of silicon contained in the silicon-containing thin film formed in the region, to an amount of aluminum supplied to a unit cell, is not less than 0.1% and not more than 2% by atomic ratio. The advantages of this claimed invention are

discussed throughout Applicant's specification, for example, page 9, line 25 through page 10, line 5. This claimed invention is not disclosed (nor suggested) by the cited reference.

Hsu et al. disclose a method of filling a high-aspect-ratio via with a metallization layer. In particular, this reference discloses, in the Background of the Invention, that aluminum alloys are known, which include a small fraction of silicon, e.g. 1% atomic (see column 1, line 59 through column 2, line 4). This reference also discloses, in the Background of the Invention, that it is known to fill vias and contact holes with metal (see column 1, lines 15-22).

This patent attempted to overcome the problems associated with the prior art by forming a silicon-rich wetting agent 500 on a surface of a dielectric layer 210, and on sidewalls of a via hole 202 which is etched in the dielectric layer 210. This reference also discloses forming a thin diffusion barrier layer 510 on the surface of the wetting agent 500, which prevents diffusion of the wetting agent 500 into a metal alloy layer 520 which is formed over the wetting agent 500. The metal alloy layer 520 is disclosed as being an aluminum alloy. This reference also discloses that in one embodiment, the aluminum alloy 520 is re-flowed into the via 202 using a sputtering operation at elevated temperatures.

Initially, it is noted that the Examiner combines features from the Background of the Invention, with features from the Detailed Description of the Preferred Embodiments, from the *Hsu et al.* patent, in establishing his anticipation rejections. That is, in the Examiner's Response to Arguments, paragraphs 13 and 14, the Action relies on teachings from the Background of the Invention, as allegedly disclosing Applicant's claimed ratio, and Applicant's claimed plurality of cells and contact holes.

However, it is respectfully submitted that it is irrelevant as to what the reference teaches in establishing an anticipation rejection. That is, it is well settled that a reference may anticipate a claim within the purview of 35 U.S.C. § 102 only if all the features and all the relationships recited in the claim are taught by the referenced structure either by clear disclosure or under the principle of inherency. In the *Hsu et al.* patent, there is no disclosure that the integrated circuit structure, which is discussed in the Detailed Description of the Preferred Embodiments, has a plurality of cells and contact holes, or the aluminum alloy features, which are discussed in the Background of the Invention. Moreover, the Action has not established that these Background features are inherent to the integrated circuit structure, which is discussed in the Detailed Description of the Preferred Embodiments. Thus, the Action appears to be impermissibly combining features in establishing the anticipation rejection. It is thus submitted that Applicant's claims are allowable for at least this reason alone.

Moreover, it is further noted that even if the rejection is proper, that the resulting combination would still be deficient in certain respects.

That is, Applicant's claim 1 does not recite that aluminum-containing thin film is alloyed with a fraction of silicon, e.g., 1% atomic, as disclosed in the Background of the Invention of the cited reference. Instead, claim 1 recites the specific ratio of the amount of silicon in the silicon-containing thin film per unit cell, to the amount of aluminum supplied to the unit cell during the forming of the aluminum thin film. This claimed ratio is fundamentally different from the disclosed alloy. That is, in order to read upon Applicant's claim 1, claim 1 would need to recite that the aluminum thin film is alloyed with silicon to 1% Atomic.

However, this is not recited in the claims, nor is the claimed ratio disclosed by the cited reference.

Further, claim 1 recites that the semiconductor substrate is provided with a plurality of cells, each of which has a contact hole. The Action relies on the Background of the Invention of the cited reference to establish that it is known to have multiple contact holes. However, it is respectfully submitted that even if the Background of the Invention does not disclose a semiconductor device includes a plurality of cells, as recited in claim 1. Instead, the Background of the Invention only discloses that it is known to fill vias and contact holes during modern integrated circuit fabrication. Simply because the term "contact holes" is referred to in the plurality, does not inherently require or result in a semiconductor device having a plurality of contact holes, as recited in claim 1. Based on this disclosure, one could instead infer that the holes are individually formed in a plurality of integrated circuits, with each integrated circuit having only one hole. Regardless of what one infers from this reference, Applicant's claim 1 is not disclosed, either explicitly or inherently, by *Hsu et al.*

Further, Applicant's claim 1 recites that the contact holes are formed in a semiconductor substrate. In contrast, to the extent that the reference does disclose a contact hole, this contact hole 202 is disclosed as being formed in a dielectric layer 210, rather than in a semiconductor substrate, as recited by claim 1.

Further, claim 1 recites heating the semiconductor substrate, upon which the aluminum-containing thin film is formed, to cause silicon to diffuse. As noted, the cited reference does not disclose a semiconductor substrate. Moreover, even if one were to assume, *arguendo*, that the dielectric layer 210 is a semiconductor

substrate, there is no disclosure that this dielectric layer 210 is heated, much less while having the aluminum alloy 520 disposed thereon, to cause silicon to diffuse.

As such, it is submitted that the Examiner's Action has failed to establish a *prima facie* case of anticipation. It is therefore requested that these claims be allowed and that these rejections be withdrawn.

It is submitted that this application is in condition for allowance. Such action and the passing of this case to issue are requested.

Should the Examiner feel that a conference would help to expedite the prosecution of this application, the Examiner is hereby invited to contact the undersigned counsel to arrange for such an interview.

Should any remittance be accidentally missing or insufficient, the Commissioner is hereby authorized to charge the fee to our Deposit Account No. 18-0002, and advise us accordingly.

Respectfully submitted,



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Date

RHB/vm